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OPERATING EXPERIENCE WEEKLY SUMMARY

Office of Nuclear and Facility Safety

April 24 through April 30, 1998

Summary 98-17

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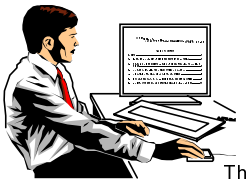

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EVENTS

1. FAILURE TO FOLLOW PROCEDURES RESULTS IN ELECTRICAL ARC

On April 13, 1998, at the Rocky Flats Environmental Technology Plutonium and Processing Facility, an electrical arc occurred inside an enriched uranium decontamination activities glovebox because a process specialist failed to follow a procedure requiring power to be turned off. Investigators believe the arc occurred as the process specialist was lifting the lid for the decontamination fixture and it, or some of the material being processed, contacted energized electrodes in the glovebox. The specialist believed she received a shock because she felt heat and experienced a slight tingling in her arm. A qualified procedure verifier secured the power to the electrodes. An assisting radiation control technician instructed the specialist to sit down, checked the area for contamination, and notified the foreman. Medical personnel determined that no injury occurred and that the specialist was probably not shocked. The facility manager directed facility personnel to apply a lockout/tagout to the system to preserve the scene for further investigation. Failure to follow procedures resulted in an electrical arc and could have resulted in a personnel injury or a fire in the glovebox. (ORPS Report RFO--KHLL-PUFAB-1998-0028)

Investigators determined that the process specialist was a trainee and was required to perform the decontamination activities under the direction of a qualified verifier. They also determined that the qualified verifier was performing other activities near the glovebox when the arc occurred and was not observing the trainee's activities.

The facility manager held a fact-finding meeting. Attendees learned that procedure steps required securing the power to the fixture and verifying that it was secured. They also learned that the specialist did not complete these procedural steps because she believed that the qualified verifier had turned off the power. The facility manager terminated all enriched uranium decontamination activities in the glovebox. He directed facility personnel to develop a re-start plan for his approval. He also directed them to complete the following actions.

- Evaluate the electrodes for additional electric shock hazards.
- Review the job hazard analysis to determine if other potential worker safety issues exist.
- Review the procedure to determine if the requirements for supervisory oversight, safety precautions, and verification are succinctly written and easily recognizable.
- Evaluate the enriched uranium decontamination training and qualification process.
- Review on-the-job training requirements and document how trainees are controlled during enriched uranium decontamination activities.
- Conduct training to stress the importance of procedural compliance, verification steps, and control of trainees and to review the hazards associated with the enriched uranium decontamination process.

NFS has reported failure to follow procedures at Rocky Flats in several Weekly Summaries. Following are some examples.

- Weekly Summary 98-05 reported that an electrical worker was injured when he fell while pulling wire through a conduit in a ceiling. The worker was standing on an 8-foot metal electrical cabinet that he was using as a work platform when he fell. Investigators determined that his work package required the use of harnesses. The harnesses were located in the room where work was being performed, but the worker failed to use them. (ORPS Report RFO--KHLL-371OPS-1998-0007)

- Weekly Summary 97-46 reported that a DOE facility representative observing residue-sampling operations noticed that two containers were not stored in designated fixed positions in a storage cabinet, violating criticality spacing requirements. Investigators determined that the residue-sampling team also violated procedures when they opened a drum containing fissionable material without obtaining a criticality safety evaluation or determining criticality safety limits. (ORPS Report RFO--KHLL-371OPS-1997-0096)

- Weekly Summary 97-24 reported that a lockout/tagout manager violated procedures by failing to perform a walk-down before issuing a lockout/tagout permit. Investigators also determined that the electricians violated electrical safety procedures when they performed a voltage check without using personal protective equipment. (ORPS Report RFO--KHLL-771OPS-1997-0027)

OEAF engineers reviewed the ORPS database from January 1, 1997, through April 29, 1998, for reports that were determined to have a root cause category of 3B (procedure not used or used incorrectly) and found 235 occurrences. We compared the rate of procedural violations (violations per 200,000 hours worked) for each DOE field office. The rate of procedural violations at the Richland, Savannah River, Ohio, and Rocky Flats operations offices is above the DOE average. The difference between the procedural violation rate at the Nevada operations office and the average DOE rate is not statistically significant. Figure 1-1 shows the procedural violation rates for each field office.

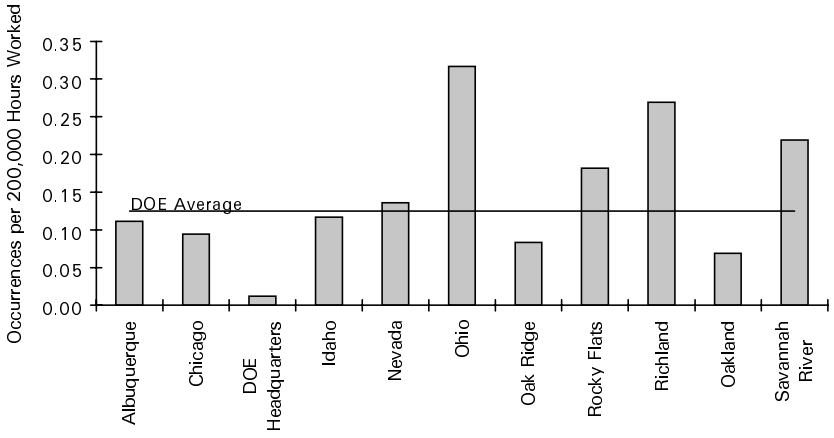

Figure 1-1. Procedural Violation Rates[1]

[1] OEAF engineers searched the ORPS database using the graphical user interface for reports with a root cause of "3B" (procedure not used or used incorrectly) AND OR Year equal to 1997 OR 1998 and found 235 occurrences. Significance testing was performed at the 90 percent probability level.

These events underscore the importance following procedures step-by-step. Some facilities have several levels of procedures, and some procedures may not be required to be available at the job site. However, verbatim procedural compliance is mandatory for all procedural levels. In addition, workers should not be precluded from obtaining any procedure and using it at the job site. Workers must assume responsibility for their work, pay attention to detail, and adhere to procedures and instructions. However, facility managers are ultimately responsible for ensuring successful completion of work activities. Routine monitoring work by facility managers and supervisors will help ensure that activities are conducted in accordance with facility policy and procedures. Facility managers must effectively communicate their expectations for procedural compliance to first-line supervisors. If supervisors responsible for overseeing work activities do not understand facility managers' expectations, they cannot expect personnel performing the work to understand them. Supervisors should receive training on procedural compliance so they can effectively enforce it and communicate its importance to workers. DOE O 5480.19, *Conduct of Operations Requirements for DOE Facilities*, chapter XVI, "Operations Procedures," provides the following guidance for procedure use.

- Facility personnel should understand the requirements for procedures.
- Facility personnel should conduct facility operations in accordance with applicable procedures that reflect the facility design.
- Facility personnel should have procedures with them and follow them in a step-by-step manner when the procedures contain sign-offs for various activities.
- Facility personnel should reference procedures during infrequent or unusual evolutions when they are not intimately familiar with the procedure requirements.

Facility managers should review the following guidance to ensure that personnel understand and follow procedures.

- DOE O 5480.19, *Guidelines for the Conduct of Operations Requirements for DOE Facilities*, chapter I, "Operations Organization and Administration," states that workers and their supervisors should be held accountable for operating performance. Personnel involved in significant or frequent violations of operating practices should be counseled, retrained, and disciplined, as appropriate. Chapter XVI, "Operations Procedures," states that procedures should be referenced during infrequent or unusual evolutions when personnel are not intimately familiar with the procedure requirements or when errors could cause significant adverse impact to the facility. DOE facility managers should ensure that all operators and supervisors are familiar with operating procedures and understand their purpose and use.

- DOE-STD-1056-93, *Guide to Good Practice for Line and Training Manager Activities Related to Training*, chapter 2, "Line Manager Responsibilities," states that line managers and supervisors should continuously emphasize the importance of conducting work activities according to approved practices and procedures. Chapter 5, "Administration of Training Activities," states that training organizations should have missions that are consistent with facility commitments and policies.

DOE/EH-0502, Safety Notice 95-02, "Independent Verification and Self-Checking," describes a technique that requires workers to (1) stop before performing the task to eliminate distractions and identify the correct component; (2) think about the task, expected response, and actions required if that response does not occur; (3) reconfirm the correct component and perform the function; and (4) review by comparing the actual versus the expected response. Human actions can be considered a barrier to provide controls over hazards associated with a job. Safety Notice 95-02 can be obtained by contacting the ES&H Information Center, (800) 473-4375, or by writing to U.S. Department of Energy, ES&H Information Center, EH-72, 19901 Germantown Road, Germantown, MD 20874.

KEYWORDS: procedures, communication, training and qualifications

FUNCTIONAL AREAS: Procedures, Management, Training and Qualification

2. WIRE ROPE CONTACTS ENERGIZED ELECTRICAL BUS

On April 15, 1998, at the Hanford Site 221-U Canyon, riggers were replacing the wire rope on a 75-ton bridge crane when one end contacted an exposed, energized, 480-volt electrical bus, causing an arc. The riggers were hoisting the wire rope up to the bridge crane with manila rope when the arc occurred. Investigators determined that the activity hazard analysis did not identify the energized bus as a hazard. Inadequate hazard analysis led to the electrical arc event and could have resulted in severe injury to personnel performing the wire rope replacement. (ORPS Report RL--BHI-IFSM-1998-0005)

The lead operator stopped the job because of a loss of power to the crane. Investigators determined that the loss of power to the crane was caused by the wire rope contacting the energized electrical bus. They also determined that the riggers and a field engineer observed the arc but did not report it because they believed it was small and affected only the non-load-bearing section of the wire rope. Investigators also determined that the field engineer and safety engineer did not perform a walk-down of the job because they did not have the training required for entry into the crane area. They also determined that no one addressed the energized electrical bus during the pre-job briefing because the field engineer and safety engineer did not recognize it as a hazard.

The facility manager ordered a new wire rope for the 75-ton crane. He also proposed the following corrective actions.

- Work planners will modify the work package for replacing the wire rope to incorporate identification of the electrical hazards associated with the exposed electrical bus and the controls necessary to mitigate the hazard.

- Work planners will walk-down the crane before the next wire rope replacement and inspect it for potential hazards.

The facility manager will also emphasize to all employees their responsibility to stop work and report abnormal or unexpected conditions.

NFS has reported on inadequate job hazard analysis in several Weekly Summaries. Following are some examples and a similar event reported in ORPS.

- Weekly Summary 96-07 reported that two construction workers at Savannah River were coiling a wire rope that was used as a lifeline during scaffolding construction on a crane catwalk when one end of the wire rope came into contact with an energized bus bar on the crane. Poor work planning resulted in the potential for personnel injury and equipment damage. (ORPS Report SR--WSRC-RBOF-1996-0004)

- Weekly Summary 96-46 reported that a subcontractor lineman at the Hanford Site used a grounding cable attached to the end of an insulated line tool to conduct zero energy checks on a pole and caused a phase-to-phase-to-ground fault. The fault created an arc, causing copper slag to burn holes in the lineman's personal protective clothing. The electrical utilities line superintendent investigated and found an energized 2,400-volt electrical circuit on the pole that was not identified during the initial work package walk-down. (ORPS Report RL--PHMC-ELEC-1996-0001)

- On October 22, 1997, at FERMI National Accelerator Laboratory, two subcontractor electrical workers installing a temporary feed from a 480-volt motor control center panel received burns when a metal cover contacted an energized bus bar. Both workers were transported to medical facilities that have burn units. The more severely burned worker required a 6-day hospital stay. A DOE Type B investigation board conducted an investigation. They determined that the electricians were not adequately informed that there were energized components behind the bus bar cover and that job planning and hazard analysis were performed informally, inadequately documented, and poorly communicated to the workers. (ORPS Report CH-BA-FNAL-FERMILAB-1997-0004)

These events underscore the importance of performing a thorough activity hazard analysis. Safety and health hazard analyses must be included in the work control process to help prevent worker injury. The following references provide guidance that should be used when conducting hazard analyses.

- DOE 440.1A, *Worker Protection for DOE Federal and Contractor Employees*, states that construction project managers shall "ensure that the project safety and health plan is approved prior to any on-site project work and that required hazard analyses are completed and approved prior to start of work on affected construction operations."

- DOE 4330.4B, *Maintenance Management Program*, section 8.3.1, provides guidelines on work control systems and procedures. It states that work control procedures help personnel understand the requirements and controls required for work. Work control managers at DOE facilities should review their programs to ensure that engineers and craftsmen understand their responsibilities and obligations.

- DOE-STD-1050-93, *Guideline to Good Practices for Planning, Scheduling, and Coordination of Maintenance at DOE Nuclear Facilities,* provides information on work controls and work coordination.

- 29 CFR 1926.400, *Safety and Health Regulations for Construction, Introduction,* addresses electrical safety requirements that are necessary for the practical safeguarding of employees involved in construction work. It also includes applicable definitions. Sub-parts 1926.416 and 1926.417 contain information and requirements about safety-related work practices. In addition to covering the hazards arising from electricity at job sites, these regulations also cover the hazards associated with accidental contact, direct or indirect, by employees with all energized lines, above or below ground, passing through or near the job.

KEYWORDS: crane, electrical safety, hazard analysis, job planning, wire rope

FUNCTIONAL AREAS: Mechanical Maintenance, Work Planning

3. OPERATOR SPRAYED WITH ACID MIST

On April 25, 1998, at the Idaho National Engineering and Environmental Laboratory Chemical Processing Plant, an operator was slightly injured when a flexible hose being used to empty an acid transfer header to a floor drain lifted out of the drain and sprayed him with a nitric acid mist. Two operators were using an approved procedure to blow-down the header with pressurized air following an acid transfer. The procedure did not require the operators to wear personal protective equipment or require an operator to secure the hose to the floor drain. The operator who was sprayed with the acid mist experienced irritation in one eye, but medical personnel determined his eye was not damaged. Inadequate procedures resulted in an operator being exposed to nitric acid with the potential for serious injury. (ORPS Report ID--LITC-WASTEMNGT-1998-0006)

Investigators determined that the operators removed a floor drain strainer plate and inserted one end of the stainless steel hose into the open drain. They determined that the hose lifted out of the floor drain as a reaction to 20 psig air rushing out of the hose after nearly all of the acid had emptied from the header and hose. The operator nearest the floor drain was exposed to a mist of acid, approximately 32 percent nitric acid by weight, blown from the hose. The operator flushed his face in the nearby decontamination room, then walked to the shower room for a more complete shower. A site physician examined the operator's eye and determined that no permanent damage resulted from the acid. A physician at an off-site hospital performed tests to confirm there was no permanent damage to the eye. Facility managers are planning corrective actions that will include modifying the procedure to (1) specify how operators are to secure the hose and (2) require operators to wear appropriate personal protective equipment while performing the procedure.

NFS has reported on occurrences involving inadequate procedures in several Weekly Summaries. Following are some examples.

- Weekly Summary 98-12 reported that an operator at the Idaho National Engineering and Environmental Laboratory Test Reactor Area inadequately secured one end of a hose that went to a drain pit sump, resulting in a spill of a reportable quantity of waste water. Investigators believed that pulsations from an air-diaphragm pump caused the hose to come out of the sump and spill approximately 15 gallons of water onto a concrete pad. Planned corrective actions included modifying the procedures to require operators to use a specially designed adapter to secure the hose to the drain pit sump. (ORPS Report ID--LITC-ATR-1998-0004)

- Weekly Summary 97-49 reported that an operator at the Idaho National Engineering and Environmental Laboratory Advanced Test Reactor was sprayed with approximately 50 milliliters of sulfuric acid foam while disconnecting an air hose to an air sparge line of an empty 8,000-gallon, bulk-acid storage tank. Procedures did not consider the sparge line air hose connection to be inside the boundaries of the work zone. Corrective actions included performing a job safety analysis and revising procedures accordingly. (ORPS Report ID--LITC-ATR-1997-0025)

- Weekly Summary 92-31 reported that operator errors and procedure deficiencies resulted in a tank overflow at the Savannah River H-Canyon facility. The controlling procedure did not contain explicit steps for operating the tank fill valve. Consequently, an operator forgot to close the fill valve, and the tank overflowed into the drain header. Corrective actions included revising procedures to identify tank and valve configurations. (ORPS Report SR--WSRC-HCAN-1992-0091)

These events underscore the importance of well-written procedures. DOE 5480.19, *Conduct of Operations Requirements for DOE Facilities*, chapter XVI, “Operations Procedures,” states that appropriate attention should be given to writing, reviewing, and monitoring operations procedures to ensure that the content is technically correct and the wording and format are clear and concise. Operations procedures should be sufficiently detailed to perform the required functions safely and without direct supervision. Operators should not be expected to compensate for shortcomings in procedures such as poor format or confusing, inaccurate, or incomplete information. DOE-STD 1029-92, *Writers Guide For Technical Procedures*, provides guidance to assist procedure writers in producing accurate, complete, and usable procedures that promote safe and efficient operations.

KEYWORDS: operating procedures

FUNCTIONAL AREAS: Procedures

PRICE-ANDERSON AMENDMENTS ACT (PAAA) INFORMATION

1. DOE ISSUES CONSENT ORDER TO KAISER-HILL

On April 14, 1998, the DOE Office of Enforcement and Investigation and the Rocky Flats Environmental Technology Site integrating management contractor, Kaiser-Hill Company, entered into a Consent Order. DOE issued the Order as a result of an internal investigation of three events that occurred between January 1996 and January 1998. The events involved: (1) 2 workers who received plutonium uptakes during a tank remediation project; (2) 17 workers who received unmonitored radiation exposures because of inadequate office area dosimetry data assessments; and (3) a sealed source custodian who received an unnecessary exposure while performing a radioactive source inventory and leak test. Investigators determined that the actual safety significance of these events was low because none of them resulted in exposures at or near the limits specified in 10 CFR 835, *Occupational Radiation Protection*. However, investigators believe that collectively these events indicate significant weaknesses in the controls necessary to perform work safely. DOE elected to issue the Consent Order, in accordance with 10 CFR 820.23, "Consent Order," instead of pursuing possible enforcement proceedings, because they determined that Kaiser-Hill investigated the events aggressively and comprehensively and implemented adequate corrective actions to prevent recurrence. Kaiser-Hill agreed to remit $100,000 in recognition of the programmatic work planning and control problems identified as a result of internal investigations. (NTS Reports: NTS-RFO--KHLL-ENVOPS-1997-0001; NTS-RFO--KHLL-SITEWIDE-1997-0009; NTS-RFO--KHLL-371OPS-1998-0001; ORPS Reports: RFO--KHLL-ENVOPS-1997-0001; RFO--KHLL-371OPS-1998-0004; and Letter, DOE (P. Brush) to Kaiser-Hill Company, L.L.C. (R. Card), 4/14/98)

Kaiser-Hill voluntarily reported the events discussed in the Consent Order to the DOE Noncompliance Tracking System for evaluation. Following is a summary of the events.

TANK REMEDIATION PROJECT

On August 12, 1996, two workers received internal intakes of 74 and 980 mrem committed effective dose equivalent of plutonium while performing underground tank remediation activities for a subcontractor. Kaiser-Hill investigators determined that the job radiological hazards escalated over several months. Radiological personnel discovered one worker uptake because of a positive routine bioassay. They discovered the second uptake because the worker requested a bioassay when he became aware of the first worker's positive bioassay. Investigators determined that no one identified the escalating hazards because no one adequately reviewed or implemented compensatory radiological planning and controls during the work. They also determined that, because of a lengthy confirmatory process, more than a year elapsed between when the workers submitted bioassay samples and when the radiological personnel notified them of the positive results. Investigators concluded that the internal dose evaluation program did not adequately demonstrate timely compliance with 1996 occupational exposure limits. They also determined that radiological work control program weaknesses included: (1) inadequate workplace radiological condition monitoring for documentation and detection of changes; (2) inadequate As Low As Reasonably Achievable (ALARA) measures for ventilation and confinement usage; (3) failure to follow procedures to maintain exposures ALARA; (4) failure to generate and maintain radiological records; and (5) inadequate airborne radioactive material area monitoring. (NTS Reports: NTS-RFO--KHLL-ENVOPS-1997-0001, RFO--KHLL-ENVOPS-1997-0001)

UNMONITORED RADIATION EXPOSURES

In September 1997, Safe Sites of Colorado initiated an investigation of office area monitoring reports that revealed high dosimeter measurements in two buildings. They determined that 17 of 80 workers received unmonitored radiation exposures in 1996 and 1997. Dose reconstruction personnel determined that these workers received greater than 100 mrem effective dose equivalent (the maximum assigned dose was 271 mrem effective dose equivalent). Investigators also determined that two declared pregnant workers worked in the office areas. Dose reconstruction personnel determined that one of the pregnant workers received 13 mrem and the other received 40 mrem effective dose equivalent. Site dosimetry personnel monitor radiation levels in uncontrolled administrative areas adjacent to radiological work areas using thermoluminescent dosimeters to identify and control potential sources of personnel exposure to radiation or radioactive material. They are required by procedures to investigate and document any area monitoring results greater than 75 mrem per quarter. Investigators determined that site dosimetry personnel failed to identify and investigate area monitoring results above 75 mrem for six quarters (January 1996 to June 1997). They also determined that the areas with high readings were adjacent to a room that contained waste residue drums. Investigators performed a root cause analysis and determined that radiological control programmatic deficiencies consisted of inadequate monitoring of declared pregnant workers, as well as other individuals; inadequate monitoring of uncontrolled areas; and inadequate administrative controls and work processes. (NTS Report NTS-RFO--KHLL-SITEWIDE-1997-0009)

SEALED SOURCE TESTING

On January 14, 1998, a sealed source custodian was exposed to radiation levels outside radiological work permit dose rates while conducting a semi-annual inventory and leak test of several selenium-75 sealed sources. Dose estimates for the custodian were 358 mrem to the hand, 119 mrem to the wrist, and 38 mrem effective dose equivalent to the lens-of-eye. The custodian removed six selenium sources from a lead storage container, held them in her hands near her eyes, inspected each one to verify the manufacturer's identification number, and swabbed them for leak tests. The supporting radiological control technician did not realize the permit dose rates had been exceeded until after the job was completed. Investigators determined that the radiological control technician was inexperienced with source inventories. They also determined that, although the job radiological work permit required a pre-job briefing, there was none. Investigators determined that the radiological work permit specified a radiation level suspension guide area dose rate of 100 mrem/hour, but the radiological control technician failed to stop work when he measured an exposure rate of 390 mrem/hour at 30 centimeters for one source. The radiological control technician discussed the job with another radiological control technician after its completion and realized that the radiological work permit suspension limit had been exceeded. Investigators determined that radiological control deficiencies consisted of inadequate area monitoring of the workplace, radiation safety training, administrative controls, and work processes. (NTS Report NTS-RFO--KHLL-371OPS-1998-0001, ORPS Report RFO--KHLL-371OPS-1998-0004)

In the Consent Order DOE acknowledged Kaiser-Hill's aggressive and comprehensive cause investigations and their open and objective assessment of the problems involved. DOE also evaluated and agreed with the adequacy of the corrective actions completed and the schedule for corrective action implementation. Therefore, DOE and Kaiser-Hill agreed to issuance of the Consent Order to "avoid potentially protracted and otherwise unnecessary additional investigation by DOE; and potential challenges on the part of Kaiser-Hill to findings by DOE, possible enforcement proceedings, Notice of Violation, and any imposed civil penalties." The Order stated

that the agreed upon non-reimbursable payment by Kaiser-Hill was significantly reduced from what could have been proposed through the formal enforcement process, but that payment does not constitute or imply admission by Kaiser-Hill of potential regulatory violations.

DOE will not pursue an enforcement action or civil penalty for any potential violations discussed in the Consent Order. DOE could take enforcement action if they determine that any of the information provided was knowingly false or inaccurate. Issuance of the Consent Order does not preclude DOE from investigating or pursuing enforcement action against Kaiser-Hill for cases other than those described in the Order or if Kaiser-Hill fails to proceed with corrective actions as outlined in their plans.

The Consent Order was issued under DOE's authority under the Price-Anderson Amendments Act (42 U.S.C. 2282a) and 10 CFR Part 820.23, “Consent Order.” Consent Orders become final 30 days after they are filed with the Secretary, unless the Secretary files a rejection. The Price-Anderson Amendments Act subjects DOE contractors to civil penalties for violations of DOE rules, regulations, and compliance orders relating to nuclear safety requirements. The Office of Enforcement and Investigation may reduce a base civil penalty by up to 100 percent when a DOE contractor promptly identifies a violation, reports it to DOE, and undertakes timely corrective action. Additionally, the enforcement policy allows DOE the discretion of not issuing a Notice of Violation in certain cases. The Noncompliance Tracking System (Weekly Summaries 95-17, 95-20) provides a means for contractors to promptly report noncompliances and take advantage of these mitigation provisions in the enforcement policy.

KEYWORDS: Price-Anderson Act

FUNCTIONAL AREAS: Licensing/Compliance, Radiation Protection